CLAIMS

Having described the preferred embodiments, the invention is now claimed to be:

1. A magnetic resonance imaging apparatus including:

a first magnetic field coil (30);

a second magnetic field coil (32); and

a power supply (40, 42) that energizes the first magnetic field coil (30) and selectively energizes the second magnetic field coil (32) to selectively generate a first magnetic field defining a first selectable field of view (FOV1) that is elongated in a first direction and a second magnetic field defining a second selectable field of view (FOV2) that is elongated in a second direction different from the first direction.

2. The magnetic resonance imaging apparatus as set forth in claim 1, further including:

a magnet housing (12) inside of which the first magnetic field coil (30) and the second magnetic field coil (32) are disposed, the magnet housing (12) defining a magnet bore (14) and a magnet bore axis (16), the first and second selectable fields of view (FOV1, FOV2) being disposed inside the magnet bore (14).

3. The magnetic resonance imaging apparatus as set forth in claim 2, wherein:

one of the first direction and the second direction is parallel to the magnet bore axis (16); and

the other of the first direction and the second direction includes a radially symmetric direction generally transverse to the magnet bore axis 16.

4. The magnetic resonance imaging apparatus as set forth in claim 2, wherein:

the first magnetic field is produced by energizing the first magnetic field coil (30) without energizing the second magnetic field coil (32); and

the second magnetic field is produced by combining the first magnetic field with a supplementary magnetic field produced by energizing the second magnetic field coil (32).

5. The magnetic resonance imaging apparatus as set forth in claim 4, wherein:

the first magnetic field includes a magnetic field component (B_o) parallel to the magnet bore axis (16); and

the supplementary magnetic field produces substantially no magnetic field component (B_o) parallel to the magnet bore axis (16).

6. The magnetic resonance imaging apparatus as set forth in claim 2, wherein:

the first magnetic field is produced by energizing the first magnetic field coil (30) and by energizing the second magnetic field coil (32) at a first non-zero current; and

the second magnetic field is produced by energizing the first magnetic field coil (30) and by energizing the second magnetic field coil (32) at a second non-zero current having an opposite current flow direction from the first non-zero current.

7. The magnetic resonance imaging apparatus as set forth in claim 2, wherein the magnet bore (14) is less than one meter long.

8. The magnetic resonance imaging apparatus as set forth in claim 2, wherein:

the first field of view (FOV1) is an ellipsoidal field of view having at least one generally circular cross-section transverse to the magnet bore axis (16); and

the second field of view (FOV2) is an ellipsoidal field of view having at least one generally circular cross-section transverse to the magnet bore axis (16).

9. The magnetic resonance imaging apparatus as set forth in claim 8, wherein:

one of the first field of view (FOV1) and the second field of view (FOV2) is a prolate ellipsoidal field of view and the other of the first field of view (FOV1) and the second field of view (FOV2) is an oblate ellipsoidal field of view.

10. The magnetic resonance imaging apparatus as set forth in claim 1, wherein:

the first magnetic field includes a sixth order harmonic and an eighth order harmonic, the sixth and eighth order harmonics having first relative polarities or signs; and

the second magnetic field includes a sixth order harmonic and an eighth order harmonic, the second magnetic field sixth and eighth order harmonics having opposite polarities or signs relative to the first magnetic field sixth and eighth order harmonics.

11. The magnetic resonance imaging apparatus as set forth in claim 1, wherein:

the first magnetic field coil (30) and the second magnetic field coil (32) are arranged as a plurality of coil packages, each coil package including a portion of the first magnetic field coil and a portion of the second magnetic field coil, the portions of the first magnetic field coil being electrically connected in series to electrically define the first magnetic field coil (30), and the portions of the second magnetic field coil being electrically connected in series to electrically define the second magnetic field coil (32).

12. The magnetic resonance imaging apparatus as set forth in claim 1, wherein the first magnetic field coil (30) and the second magnetic field coil (32) are relatively arranged such that there is substantially no mutual inductance therebetween.

13. The magnetic resonance imaging apparatus as set forth in claim 1, further including:

a feedback controller (80) controlling the power supply (40, 42) to maintain a constant energizing of the first magnetic field coil (30) during switching between the first field of view (FOV1) and the second field of view (FOV2).

14. The magnetic resonance imaging apparatus as set forth in claim 1, wherein the magnet bore (14) has a length (L_{bore}) which is equal to or shorter than a bore diameter (D_{bore}).

15. The magnetic resonance imaging apparatus as set forth in claim 1, further including:

a variable field of view magnetic field gradient coil (50) that produces a substantially linear magnetic field gradient within a volume selected to generally coincide with the selected one of the first field of view (FOV1) and the second field of view (FOV2).

16. A method for producing a selectable field of view for magnetic resonance imaging, the method including:

energizing at least a first magnetic field coil (30) to generate a first magnetic field defining a first generally ellipsoidal field of view (FOV1) having a first cross-sectional dimension transverse to a magnet bore axis (16) and a first length along the magnet bore axis (16); and

energizing the first magnetic field coil (30) and a second magnetic field coil (32) to generate a selectable second magnetic field defining a second generally ellipsoidal field of view (FOV2) having a second cross-sectional dimension transverse to the magnet bore axis (16) and a second length along the magnet bore axis (16), a ratio between the first cross-sectional dimension and the first length being different from a ratio between the second cross-sectional dimension and the second length.

17. The method as set forth in claim 16, further including:

varying the selective energizing of the second magnetic field coil (32) to adjust between the first and second magnetic fields, the adjusted magnetic field defining an adjusted field of view having a spatial extent intermediate between the first field of view (FOV1) and the second field of view (FOV2).

18. The method as set forth in claim **16**, wherein the selective energizing of the second magnetic field coil **(32)** includes:

energizing the second magnetic field coil **(32)** at a first non-zero current to produce the first magnetic field defining the first generally ellipsoidal field of view **(FOV1)**; and

energizing the second magnetic field coil **(32)** at a second non-zero current different from the first non-zero current to produce the second magnetic field defining the second generally ellipsoidal field of view **(FOV2)**.

19. The method as set forth in claim **16**, wherein:

one of the first generally ellipsoidal field of view **(FOV1)** and the second generally ellipsoidal field of view **(FOV2)** is a prolate ellipsoidal field of view and the other of the first generally ellipsoidal field of view **(FOV1)** and the second generally ellipsoidal field of view **(FOV2)** is an oblate ellipsoidal field of view.

20. The method as set forth in claim **16**, wherein:

the first and second cross-sectional dimensions are radii of circular cross-sections of the generally ellipsoidal fields of view **(FOV1, FOV2)** transverse to the magnet bore axis **(16)**.